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LAUNCH SERVICES PROGRAM

NASA Launch Services Program

Mars Exploration Program Mars Scout AO Pre-proposal Conference

**Norman Beck
May 17, 2006**



Agenda

- NASA Launch Services Program/Polices
- Launch Vehicle Certification
- Mission Management/Customer Interface
- Major Milestones/Launch Readiness Reviews
- Cost vs Performance



NASA Launch Services Program

- **Charter: Provide commercially available ELV launch services acquisition and management for NASA missions and customers.**
- **Objectives: to ensure ELV mission success, provide launch services on-time, and maximize customer satisfaction**
- **Primary Functions:**
 - **NASA Launch Services Contract acquisition/management**
 - **Budget development/execution**
 - **Mission Integration Management – “cradle-to-grave”**
 - **Core vehicle engineering, production, test, and operations insight**
 - **Mission Analysis & Design**
 - **Launch Site Integration Management**
 - **Communications/Telemetry**
 - **Advanced Missions Planning**
 - **Safety & Mission Assurance**



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NASA ELV Policies



NASA ELV Policies

- NASA KSC ELV work is governed/driven by the following Agency-level NASA Policy Directives (NPD):
 - NPD 8610.7, Launch Services Risk Mitigation Policy for NASA-Owned Or NASA-Sponsored Payloads
 - NPD 8610.23, Technical Oversight of Expendable Launch Vehicle (ELV) Launch Services
 - NPD 8610.24, Expendable Launch Vehicle (ELV) Launch Services Pre-launch Readiness Reviews
- These policies flow-down into Center-level documentation, which documents the “how-to”.



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Launch Vehicle Certification



Launch Vehicle Certification

- Purpose: To outline NASA Headquarters requirements for expendable launch services risk mitigation and to discuss KSC's responses to requirements in terms of documentation and processes
- Key Documentation and Processes include:
- NPD 8610.7 "Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads"
 - LSP-PLN-324.01 "Expendable Launch Vehicle Certification"
 - LSP-P-324.01 "Expendable Launch Vehicle Certification Process"

NASA Documentation (NPD, KPD) referenced here can be found at the following web address:

<http://nodis.hq.nasa.gov/>

A User Guide can be found at the following location;

http://nodis.hq.nasa.gov/Library/Directives/NASA-WIDE/MSWord_Docs/N_PG_1000_0002_.pdf

NASA KSC LSP Documentation (LSP) referenced here can be found at the following web address:

<http://tdsearch.ksc.nasa.gov/search/general.html>



NASA ELV Certification Status

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- Pegasus XL – Cat 3 certification complete
- Taurus XL – Cat 2 certification in work
- Delta II – Cat 3 certification complete
- Delta IV – No formal efforts yet in work, no manifested missions
- Atlas V – Cat 3 certification complete

Attachment D-4 NASA ELV Certification Requirements

	Risk Category 1	Risk Category 2	Risk Category 3		
Vehicle Maturity	No launch experience	Initial Launch	Production Launch Vehicles		
Management Systems	ISO 9001 Third Party Certification required	ISO 9001 Third Party Certification required	ISO 9001 Third Party Certification required		
Flight Experience (See Notes)	Plans in Place: Instrumentation Post Flight Operations/Anomaly Resolution Process Flight Margin Verification	Completed: 1 or more successful Instrumented Flight(s) Post Flight Ops/Anomaly Resolution Process Flight Margin Verification	Completed: Series of 3 or more consecutive successful flights of a common vehicle configuration from an evolved vehicle family produced by an LSP with demonstrated flight history Flight Margin Verification	Completed: Series of 6 or more (minimum of 3 consecutive) successful flights of a common vehicle configuration from an evolved vehicle family produced by an LSP with demonstrated flight history Flight Margin Verification	Completed: Series of 14 or more consecutive successful flights of a common vehicle configuration Flight Margin Verification
Design	95% predicted design reliability Space qualified H/W (for application) Documented ICD Process	95% predicted design reliability	95% predicted design reliability	95% Predicted design reliability NASA Design Certification Review prior to Flight Margin Verification (A two week review with 20 to 25 KSC personnel in attendance)	No additional qualification requirements for common vehicle
Manufacturing / Ops	NEQA-Type Audit	NEQA-Type Audit	NEQA-Type Audit		
System Safety	FMEA for all critical components Prelim/Final Hazard Analysis	Demonstrated safety system	Demonstrated safety system		
Test & Verification	Acceptance Test Plan in place. Ground Test, Qual & End-To-End Test Complete	Comprehensive acceptance test results	Comprehensive acceptance test results		
Quality Systems / Process	NEQA-Type Audit	NEQA-Type Audit	NEQA-Type Audit		
Flight Hardware and Software Qualification	None	Series of NASA KSC ERB's on vehicle subsystems	Series of NASA KSC ERB's on vehicle subsystems		
LV Analysis	None	None	Prudent IV&V		
Risk Assessment	None	None	Full vehicle fishbone		
LSP Risk Plan LSP Past Performance Management Design & Eng Processes	None	None	NEQA-Type Audit		
Launch Complex	None	NAS KSC ERB	NASA KSC ERB		

Notes: 1) Vehicle failures do not invalidate vehicle certification if NASA ERB concurs with cause and corrective action. Category 3 requires NASA participation in the LSP investigation. 2) Major vehicle upgrades may require additional NASA technical penetration. 3) Full engineering insight per NPD 8610.23 applied to all categories except for secondary payloads

This column is identical to existing alternate method category 3 with revised flights, added fishbone, and deleted audits

Shaded items are part of K-ELV-10.2 for the alternate method category 3

No changes to this column from existing 8610.7 category 3



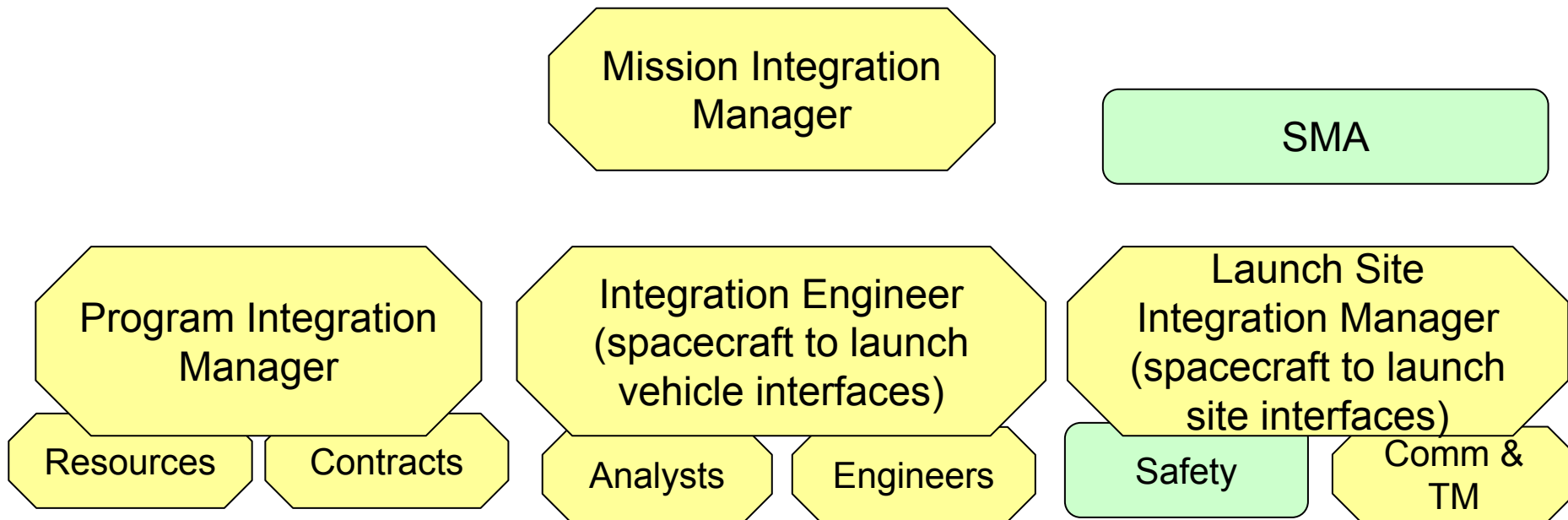
Mission Management



Typical LSP Mission Integration Team (MIT)

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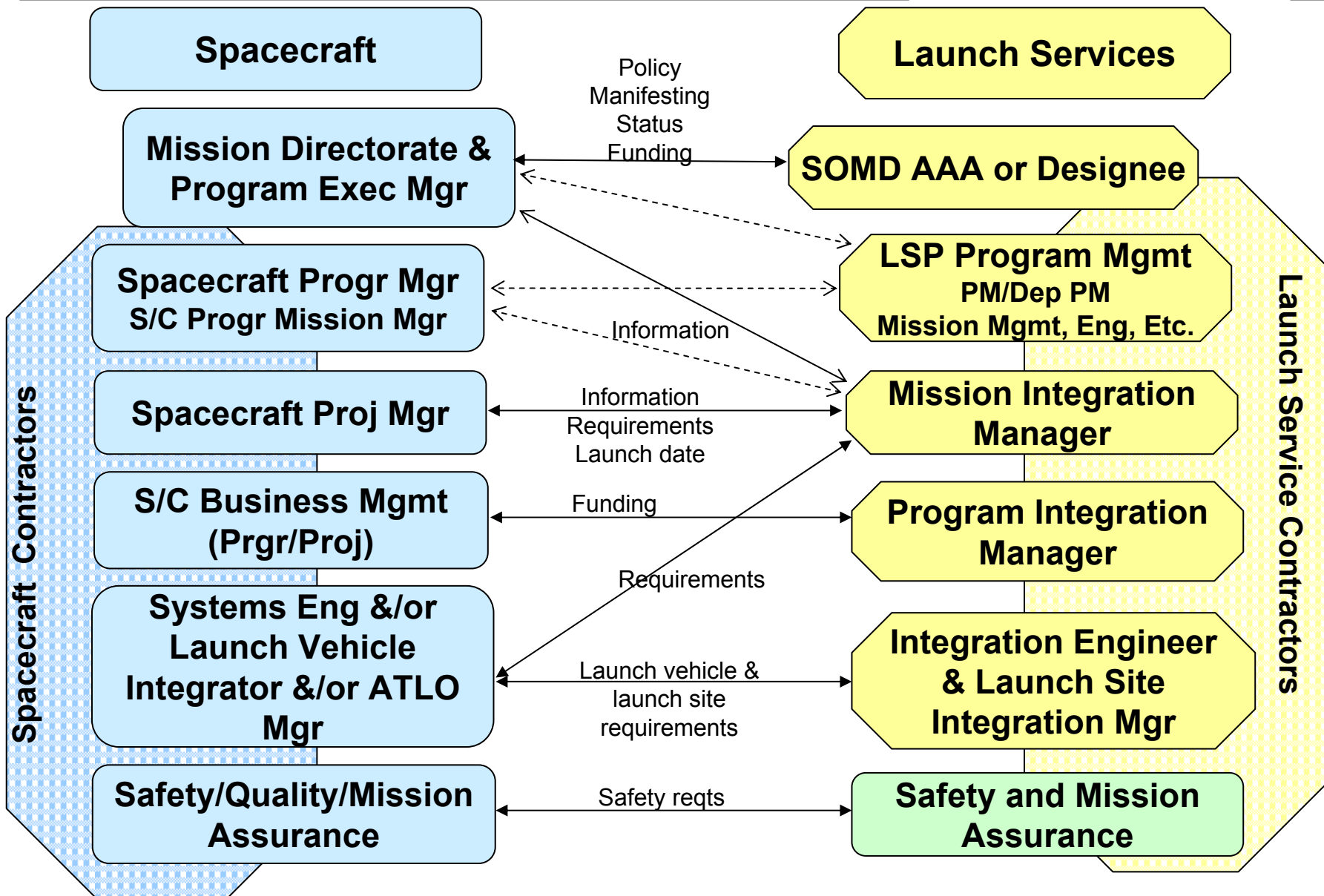
- **Matrixed team of disciplines from across LSP**
- **SMA also provides key functions– independent reporting**
- **Sub-teams support each primary MIT element**



Typical Mission Communication Paths

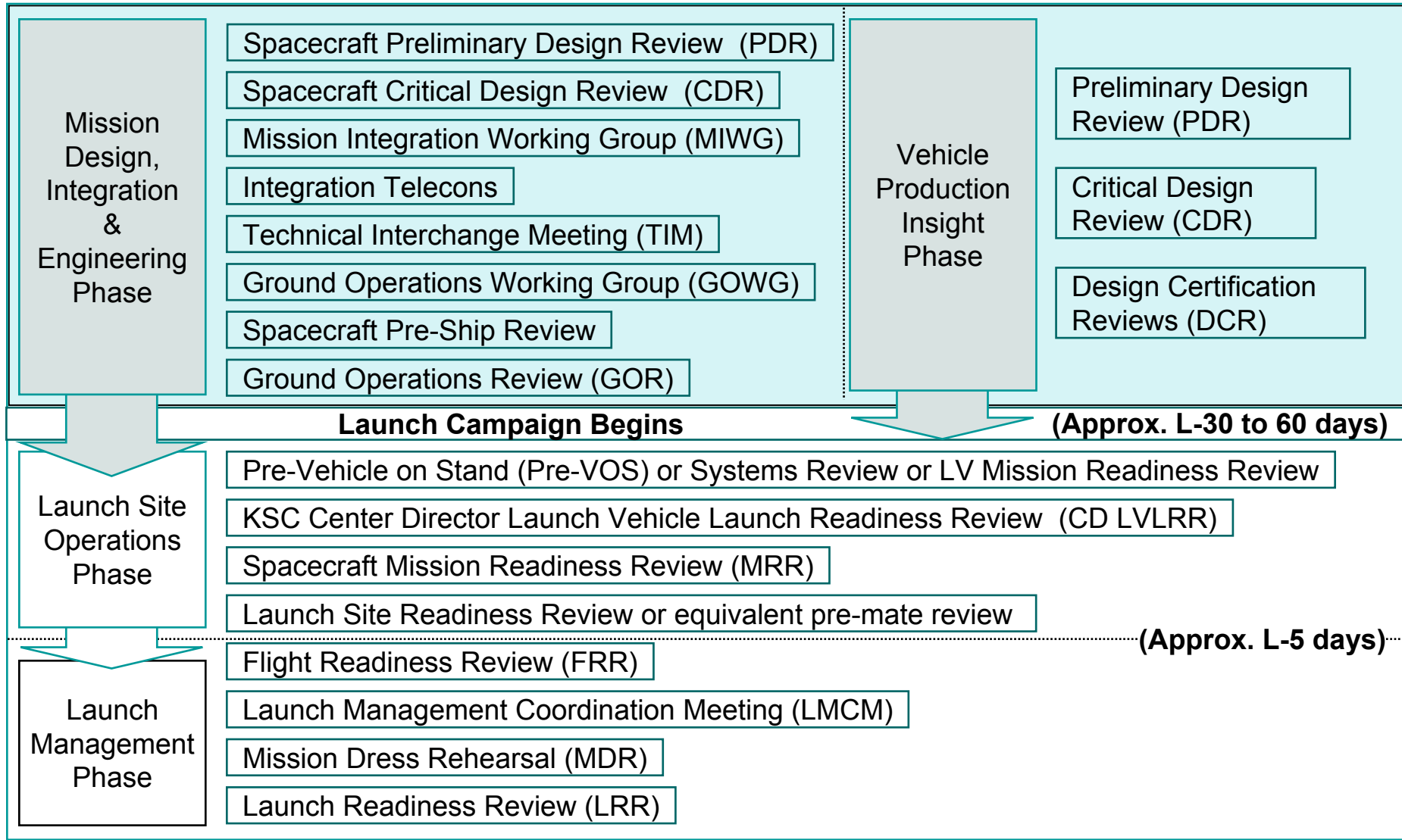
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REVIEW FLOW DURING MISSION CYCLE

The following table provides an overview of the meetings and reviews and their flow during mission cycle





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Cost vs Performance



FY 2012 Launch

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ELV Launch Service Class (non-nuclear)

Mars Scout NOA Pricing Summary – NLT January 31, 2012 Launch							
Performance Range (Kg) <small>See Notes</small>	Launch Date NLT	Launch Site	FY 08	FY 09	FY 10	FY 11	Total
C3 = 8							
9.5' PLF 0-1040	Jan 31 2012	CCAFS	1	22	37	45	105
9.5' PLF 1041-1200	Jan 31 2012	CCAFS	1	24	42	51	118
4m PLF 0-2955	Jan 31 2012	CCAFS	1	31	52	64	148
5m PLF 0-2250	Jan 31 2012	CCAFS	1	33	55	68	157
5m PLF 2250-3910	Jan 31 2012	CCAFS	1	37	64	77	179



FY 2012 Launch

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ELV Launch Service Class (non-nuclear)

Mars Scout NOA Pricing Summary – NLT January 31, 2012 Launch							
Performance Range (Kg) See Notes	Launch Date NLT	Launch Site	FY 08	FY 09	FY 10	FY 11	Total
C3 = 12							
9.5' PLF 0-1105	Jan 31 2012	CCAFS	1	24	42	51	118
4m PLF 0-2725	Jan 31 2012	CCAFS	1	31	52	64	148
5m PLF 0-2050	Jan 31 2012	CCAFS	1	33	55	68	157
5m PLF 2250-3620	Jan 31 2012	CCAFS	1	37	64	77	179
Nuclear Costs		FY 08	FY 09	FY 10	FY 11	FY 12	Total
RHU Mission		1	1	2	2	2	8



Cost Table Notes

- Performance class estimate to C3 = 8 and 12.
- Performance ranges from 0 to 3910 Kg for C3=8 and 0-3620 for C3=12 are an estimate. There is no guarantee that launch services in this range will be available to support these launch dates.
- Prices for C3 of 8 performance ranges 0 – 1040 kg and 1041 – 1200 kg as well as the C3 of 12 performance range 956 - 1105 kg DO NOT include Pad Sustainability costs after 2009. Full sustainability costs of an estimated \$30M per year for CY 2010, 2011, and 2012 are anticipated for these performance ranges. This may be less if more missions launch during this timeframe.
- Fluctuation of the cost of the launch vehicle will not be the responsibility of the PI once the mission is selected for flight (end of phase B) with the exception that the PI is responsible for any costs resulting from a change in launch vehicle requirements generated by the mission at any time in the development of the mission.



Cost Table Notes Cont.

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- Prices beyond 2010 launch dates are notional and are subject to change. They are based on the current NLS contract. PI should hold reserves to cover unexpected PRICE fluctuations associated with Eastern and Western Range capability and market fluctuations associated with the launch service industry.
- Launch Service will be competed through the LSTO Acquisition Process. The launch service prices are estimates and are not to be considered commitments from the Launch Service Program.
- The funding profiles provide for the launch service, nominal allocation for mission unique launch vehicle modifications/services, mission integration, launch site payload processing, range safety, and telemetry/communications. Budget does not include delays
- All costs are estimated in real-year dollars (order year=L-27 mo.) based on current NLS contract information. Phasing reflects 30 months integration cycle standard for EELV class.



ELV Advance Mission Planning Support

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